Neural Engineering Workshop

Description

During this workshop students will learn how to build their own scientific tools to extract electrical activity from living organisms to study their behaviour. They will also learn to use the nervous system's electrical activity to make Brain-computer interfaces, that can be used for artistic, scientific or educational purposes.

Main objective

The main objective is that students can understand the essence of doing science: the importance of creativity to build, adapt and share tools that are aimed to answer questions. We want the students to understand the strong bond between science, creativity, and action in this interdisciplinary workshop.

SCHEDULE OF ACTIVITIES

N° SESSIONS	CONTENT
1	Introduction to Neuroscience talk: ● What are neurons and how they communicate ● What is an action potential or spike: calcium, potassium and ionic channels. ● Methods to study the brain: lesions, micro stimulation and optogenetics. ● Amplifying and recording neuronal activity from invertebrates ● Recording electrical muscle activity from humans ● Recording brain from humans using EEG device ● Recording electrocardiogram ● Brain-Machine interfaces Hands on activity: Replicating the Galvani-Volta experiment ● Build a replica of the very first battery, invented by Volta and which began the electronics revolution

	• Stimulate the nerves of a cockroach leg, in an adaptation of Luigi Galvani's famous frog leg experiments.
2	Electronics Principles for building your own DIY Neuroscience Tools • Basic electronic components for making circuits • What's a transistor and how it works: amplification. • Reading Circuit Schematics to build circuits in a breadboard • Build a first stage bioamplifier.
3	Electronics Principles for building your own DIY Neuroscience Tools • Build a two stages bioamplifier in a breadboard, reading the circuit schematics. • Students project: add a led to the end of the circuit, to tell if the circuit is closed.
4	Microscopy • Build a DIY microscope: make your own lens just as Leeuwenhoek did with the fist microscope: melting glass and creating a small sphere for high magnification. Our version microscope is also designed so users can take pictures and videos with their smartphones. Students will take the microscope they build with them. • Explore the school to find microscopic objects to observe: water, insects, onion, cork...
5	Neuroscience experiments with invertebrates • Effect of Temperature on neurons • Oxygen and Spiking • Conduction velocity: how fast is a neuron • Neuropharmacology-Effect of Nicotine and MSG on Neurons • Effect of Temperature on Conduction Velocity
6	Neuroscience experiments with rapid movement plants • Venus Fly Trap Electrophysiology • Sensitive Mimosa Electrophysiology • Replicate the Plant-Plant interface experiment that we showed in our new Ted Talk • New experiment: Can we record electricity from a plant that can't make rapid movements?

7	**Brain Machine Interfaces** ● Introduction: Using the body's electrical to control machines with Arduino ● Programming relays, LEDs and servos to be controlled with muscle electrical signals.
8	**Personal projects: prototyping** Students can chose between building their own Brain Machine interface or making a Neuroscience experiment. In this session they will prototype the implementation of the project they chose. They can chose to make a project that will experiment with other programs from the symposium like music or dance: they can create music interfaces, or a light show activated by the muscles of instrument players, or measure muscle electrical activity during dance… This are just some examples to show the interdisciplinarity of neural engineering, which can make it a good element to join different workshops form the symposium together.
9	**Personal projects: documentation** Students will document with pictures and writing the process and methodology of their experiment so it can be replicated by the community. Personal projects that are well documented to replicate experiments will be uploaded to the website of Backyard Brains, and sent in our monthly international newsletter that has 8.000 subscribers
10	**Personal projects: blogpost**

Price of total Symposium program without materials: $1.900.800 CLP

Cost of kit of materials per each student (includes microscope kits that each student keeps and takes home, and bioamplifiers borrowed): $31.560 CLP